What Is Claimed Is:

1. An exposure apparatus that performs exposure to an object via a projection optical system, the apparatus comprising:

a stage that is movable in at least directions of three degrees of freedom that include an optical axis direction of the projection optical system and two-dimensional directions within a plane orthogonal to the optical axis while holding the object, and can adjust a position of the object in the optical axis direction;

a first position detection unit that detects position information of the stage in the optical axis direction;

a second position detection unit that detects position information of the stage within the plane orthogonal to the optical axis;

a surface shape detection system that detects information related to a surface shape of a surface subject to exposure of the object held on the stage, prior to the exposure; and

an adjustment unit that adjusts a surface position of the surface subject to exposure of the object by driving the stage based on the detection results of the surface shape detection system and the detection results of the first and second position detection units, when performing exposure to the object.

2. The exposure apparatus of Claim 1, further

comprising:

a measurement unit that measures a best focus position of the projection optical system, wherein

the adjustment unit adjusts a surface position of the surface subject to exposure of the object, using the measurement results of the measurement unit as a datum.

3. The exposure apparatus of Claim 2 wherein

the measurement unit has an aerial image measurement instrument that is arranged on the stage and measures an aerial image formed by the projection optical system via a predetermined measurement pattern that is arranged within the plane orthogonal to the optical axis of the projection optical system, measures a change of the aerial image in at least one point within an effective exposure field, with respect to a change of the position of the stage in the optical axis direction, and measures the best focus position of the projection optical system based on the measurement results.

4. The exposure apparatus of Claim 1, further comprising:

an off-axis alignment system that is used to detect an alignment mark formed on the object, wherein

the surface shape detection system has a focal point position detection system that detects a position of the surface subject to exposure of the object in the optical axis direction when the alignment mark is detected by the alignment system, and detects the information related to the surface

shape of the surface subject to exposure of the object based on the detection results of the focal point position detection system and on the detection results of the second position detection unit when the position of the surface subject to exposure of the object in the optical axis direction is detected by the focal point position detection system.

5. The exposure apparatus of Claim 4 wherein the focal point position detection system is a multiple focal point position detection system that can severally detect a position of the surface subject to exposure of the object in the optical axis direction at each of a plurality of measurement points on the object by irradiating a measurement light to the plurality of measurement points and detecting a reflected light reflected off the measurement points.

6. The exposure apparatus of Claim 5 wherein the surface shape detection system detects a detection origin deviation between the measurement points, and detects a surface shape of the surface subject to exposure of the object taking the detection results into consideration.

7. The exposure apparatus of Claim 1 wherein the surface shape detection system includes an irradiation system that irradiates an illumination light to a strip-shaped area that the object held on the stage crosses by movement of the stage and a photodetection system that

receives a reflected light of the illumination light from the surface subject to exposure of the object when the object crosses the strip-shaped area, and detects the information related to the surface shape of the surface subject to exposure of the object based on a position deviation amount from a datum position of a photodetection position of the reflected light in the photodetection system.

8. The exposure apparatus of Claim 1 wherein the surface shape detection system has an interferometer, and detects the information related to the surface shape of the surface subject to exposure of the object using the interferometer.

9. The exposure apparatus of Claim 8 wherein the interferometer is an oblique incident interferometer whose lightwave enters the surface subject to exposure of the object from an oblique direction.

10. The exposure apparatus of Claim 1 wherein the adjustment unit takes into consideration the position information of the stage in the optical axis direction detected by the first position detection unit, when the information related to the surface shape of the surface subject to exposure of the object is detected by the surface shape detection system, and adjusts a surface position of the surface subject to exposure of the object, when performing exposure to the object.

11. The exposure apparatus of Claim 1 wherein

the surface shape detection system detects information related to a relative position in the optical axis direction between the surface subject to exposure of the object and a datum plane of the stage, along with the information related to the surface shape of the surface subject to exposure.

12. The exposure apparatus of Claim 11, further comprising:

a detection mechanism that can detects a position of the stage in the optical axis direction via the projection optical system, wherein

prior to the exposure, the adjustment unit specifies a surface position of the surface subject to exposure of the object in the optical axis direction, based on the detection results of the detection mechanism, the information related to the relative position and the information related to the surface shape of the surface subject to exposure of the object.

13. The exposure apparatus of Claim 12 wherein

the adjustment unit detects a difference between a detection datum of the detection mechanism and the best focus position of the projection optical system, and adjust a surface position of the surface subject to exposure of the object taking the detection results into consideration.

14. The exposure apparatus of Claim 1 wherein

detection of the information related to the surface position of the surface subject to exposure of the object is performed in a state where the space between the surface shape detection system and the object is not filled with a liquid, and

the exposure is performed in a state where the space between the projection optical system and the object is filled with a liquid.

15. A device manufacturing method that includes a lithography process in which a device pattern is transferred onto an object using the exposure apparatus according to any one of Claims 1 to 14.

16. An exposure method in which exposure is performed to an object via a projection optical system, the method comprising:

a detection process in which information related a datum position of the object in an optical axis direction of the projection optical system is detected, along with information related to a surface shape of a surface subject to exposure of the object in the optical axis direction, prior to exposure; and

an exposure process in which exposure is performed while adjusting a surface position of the surface subject to exposure of the object based on the detection results.

17. The exposure method of Claim 16, further comprising:

a best focus measurement process in which a best focus position of the projection optical system is measured, prior to the exposure process, wherein

in the exposure process, a surface position of the surface subject to exposure of the object is adjusted using the best focus position of the projection optical system as a datum.

18. The exposure method of Claim 16, further comprising:

a calibration process in which calibration of a detection system is performed prior to the detection process, the detection system detecting the information related to a datum position of the object in the optical axis direction of the projection optical system, along with the information related to the surface shape of the surface subject to exposure of the object in the optical axis direction.

19. The exposure method of Claim 16 wherein

the detection process is performed during detection of an alignment mark formed on the object.

20. The exposure method of Claim 16 wherein

in the detection process, as the information related to the datum position of the object in the optical axis direction, position information of a stage holding the object

in the optical axis direction when the information related to the surface shape of the surface subject to exposure is detected.

21. The exposure method of Claim 16 wherein

in the detection process, as the information related to the datum position of the object in the optical axis direction, information related to a relative position in the optical axis direction between a datum plane of the stage holding the object and the surface subject to exposure.

22. The exposure method of Claim 21, further comprising:

a datum plane position detection process in which a position of a datum plane of the stage in the optical axis direction is detected via the projection optical system, prior to the exposure process, wherein

in the exposure process, a surface position of the surface subject to exposure of the object in the optical axis direction is specified, based on the detection results of the datum plane position detection process, the information related to the relative position and the information related to the surface shape of the surface subject to exposure of the object.

23. The exposure method of Claim 22, further comprising:

a calibration information detection process in which

a datum position of a surface position of the surface subject to exposure of the object and the best focus position of the projection optical system are detected as calibration information, prior to the datum plane position detection process, wherein

in the exposure process, a surface position of the surface subject to exposure of the object is adjusted taking the calibration information into consideration.

24. The exposure method of Claim 16 wherein

in the exposure process, exposure is performed to the object in a state where the space between the projection optical system and the object is filled with a liquid.

25. A device manufacturing method that includes a lithography process in which a device pattern is transferred onto an object using the exposure method according to any one of Claims 16 to 24.

26. A surface shape detection unit, comprising:

a stage that can hold an object and is movable in a predetermined direction;

an irradiation system that irradiates an illumination light to a strip-shaped area that the object held on the stage crosses by movement of the stage;

a photodetection system that receives a reflected light of the illumination light from a surface subject to exposure of the object when the object crosses the strip-shaped

area;

a detection unit that detects information related to a surface shape of the surface subject to exposure of the object, based on a position deviation amount from a datum position of a photodetection position of the reflected light in the photodetection system.

27. An exposure apparatus, comprising:

a stage that can hold an object subject to exposure and is movable in a predetermined direction;

a detection unit that has an irradiation system to irradiate an illumination light to a strip-shaped area that the object held on the stage crosses by movement of the stage and a photodetection system to receive a reflected light of the illumination light from a surface subject to exposure of the object when the object crosses the strip-shaped area, and detects information related to a surface shape of the surface subject to exposure of the object based on output of the photodetection system; and

a controller that controls the stage so that the object crosses the strip-shaped area, and performs surface position adjustment of the surface subject to exposure of the object based on information of a surface shape of a substantially entire area of the surface subject to exposure of the object, the information being obtained by the object crossing the strip-shaped area once.

28. The exposure apparatus of Claim 27, further

comprising:

an optical system that is used to irradiate an exposure light to the object; and

an immersion mechanism that fills the space between the object and the optical system with a liquid, wherein

the detection unit detects the information related to the surface shape of the surface subject to exposure of the object, before the immersion mechanism fills the space between the object and the optical system with a liquid.

29. The exposure apparatus of Claim 28, further comprising:

an alignment system that detects an alignment mark on the object, wherein

the alignment system detects the alignment mark on the object before the immersion mechanism fills the space between the object and the optical system with a liquid.

30. The exposure apparatus of Claim 29 wherein

the detection unit detects the information related to the surface shape of the surface subject to exposure of the object after the alignment system detects the alignment mark.

31. The exposure apparatus of Claim 29 wherein

the detection unit detects the information related to the surface shape of the surface subject to exposure of the object before the alignment system detects the alignment mark.

32. A device manufacturing method that includes a lithography process in which a device pattern is formed on an object using the exposure apparatus according to any one of Claims 27 to 31.